FOR

CLIPPEDIMAGE= JP401274838A

PAT-NO: JP401274838A

DOCUMENT-IDENTIFIER: JP 01274838 A

TITLE: DEVICE FOR OPTIONALLY SOLIDIFYING SUPERCOOLED LIQUID

PUBN-DATE: November 2, 1989

INVENTOR-INFORMATION:
NAME
OKUAKI, KOICHI
SUZUKI, JUNTARO
SHIRAKAWA, HIROSHI

ASSIGNEE-INFORMATION:
NAME COUNTRY
NOK CORP N/A

APPL-NO: JP63102089

APPL-DATE: April 25, 1988

INT-CL (IPC): B01J019/06;C22C019/03 ;F28D020/00

US-CL-CURRENT: 62/602

ABSTRACT:

PURPOSE: To reduce the total cost of the title device and to ensure the reproducibility of solidification by obtaining the sliding frictional force to be imparted to a heat accumulating material from a combination of a spring made of a shape memory alloy and having a successively variable diameter and a spring made of stainless steel.

CONSTITUTION: A combination of the inclined spring 1 made of a shape memory alloy capable of transforming when the temp. of the liq. heat accumulating material decreases below the m.p. and the spring 2 made of stainless steel is placed in a box 3 made of stainless steel, and both ends are fixed. When the device is placed in a hermetically sealed vessel along with the heat accumulating material, the spring 1 is contracted and the spring 2 is expanded at ordinary temp. When the heat accumulating material is then heated to a temp. above the m.p., the spring 1 is expanded and the spring 2 is contracted, and the spring 1 is instantaneously transformed when the material is further heated and then cooled to the m.p. Consequently, nucleus is originated, the latent heat is given off, and the heat insulating performance is maintained.

126/263.3

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平1-274838

⑤Int. Cl.⁴	識別記号	庁内整理番号	㊸公開　平成1年(1989)11月2日
B 01 J 19/06		6865-4G	
C 22 C 19/03		A-6813-4K	
// F 28 D 20/00		F-7380-3L	審査請求　未請求　請求項の数 6　(全10頁)

㊹発明の名称　過冷却液体の任意固化装置

㉑特　願　昭63-102089
㉒出　願　昭63(1988)4月25日

㉒発明者　奥秋　光一　神奈川県藤沢市辻堂新町4-3-1　エヌオーケー株式会社内
㉒発明者　鈴木　潤太郎　神奈川県藤沢市辻堂新町4-3-1　エヌオーケー株式会社内
㉒発明者　白川　洋　神奈川県藤沢市辻堂新町4-3-1　エヌオーケー株式会社内
㉑出願人　エヌオーケー株式会社　東京都港区芝大門1丁目12番15号
㉔代理人　弁理士　中林　幹雄

明細書

1.発明の名称

過冷却液体の任意固化装置

2.特許請求の範囲

(1) 過冷却状態にある蓄熱材に摺動摩擦力を付与し、それにより潜熱を取り出すようになった過冷却液体の任意固化装置であって、該過冷却液体の任意固化装置は、形状記憶合金製であるとともに順次径が異なっているばね(1)と、ステンレス製のばね(2)と、両ばねを重ねた状態で収納するステンレス製の箱(3)とからなり、形状記憶合金が形状変化を生じるまでは、前記形状記憶合金製のばね(1)がステンレス製のばね(2)により押圧変位され、形状変化した際は前記ステンレス製のばね(2)が押圧変位されることを特徴とする過冷却液体の任意固化装置。

(2) 過冷却状態にある蓄熱材に摺動摩擦力を付与し、それにより潜熱を取り出すようになった過冷却液体の任意固化装置であって、該過冷却液体の任意固化装置は、形状記憶合金製のばね(5)と、ステンレス製のばね(6)とを組み合わせてステンレス製の箱(7)の内部に収納し、形状記憶合金の形状変化時に摺動摩擦力を付与するようにしたことを特徴とする過冷却液体の任意固化装置。

(3) 過冷却状態にある蓄熱材に摺動摩擦力を付与し、それにより潜熱を取り出すようになった過冷却液体の任意固化装置であって、該過冷却液体の任意固化装置は、密着部を有するコイル状のばね(11)(13)を具え、このばね(11)(13)の変位時に密着部で摺動摩擦力を付与するようにしたことを特徴とする過冷却液体の任意固化装置。

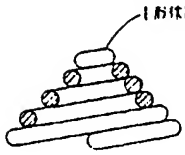
(4) 過冷却状態にある蓄熱材に摺動摩擦力を付与し、それにより潜熱を取り出すようになった過冷却液体の任意固化装置であって、該過冷却液体の任意固化装置は、密着部を有するコイル状のばね(11)(50)と、このばね(11)(50)を変位して密着部で摺動

55……容器蓋

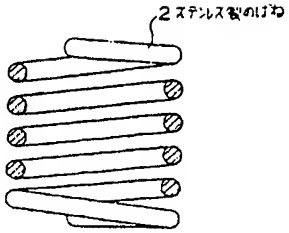
特許出願人　エヌオーケー株式会社

代理人　弁理士　中　林　幹　雄

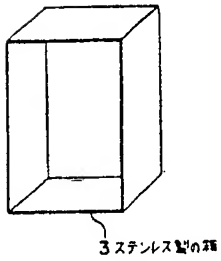
第1図



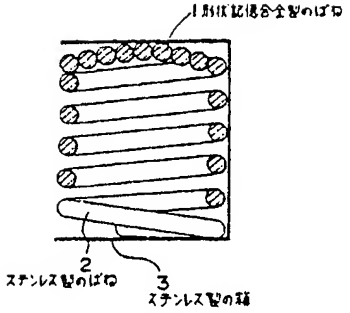
第2図



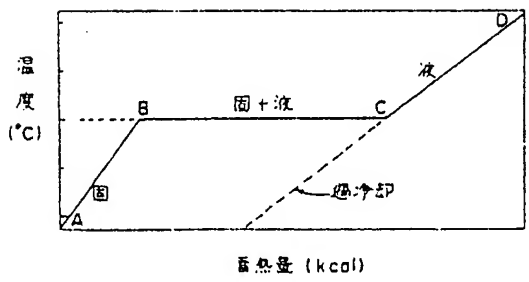
第3図



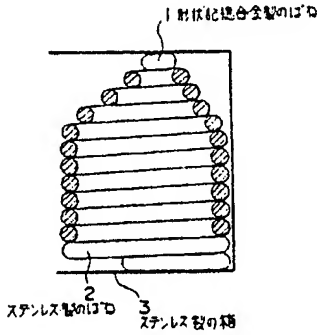
第4図



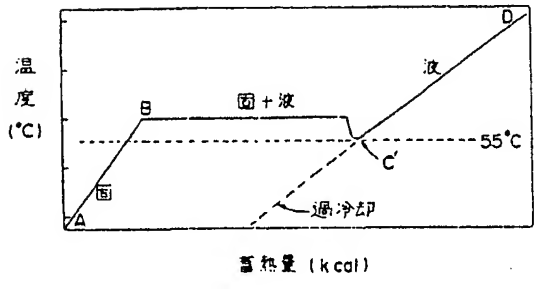
第5図



第6図



第7図



PTO 2003-161

Japan Kokai
Japanese Patent Publication
Publication No.: 1-274838

OPTIONAL SOLIDIFYING DEVICE FOR SUPERCOOLING FLUID
[Ka reikyaku ekitai no nin-i koka sochi]

Koichi Okuaki et al

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. October 2002

Translated by: Schreiber Translations, Inc.

Country	: Japan
Document no.	: 1-274838
Document type	: Patent Publication
Language	: Japanese
Inventor	: Koichi Okuaki et al
Applicant	: Enuo-ke Co., Ltd
IPC	: B 01 J 19/06; C 22 C 19/03; //F 28 D 20/00
Application date	: April 25, 1988
Publication date	: November 2, 1989
Foreign language title	: Ka reikyaku ekitai no nin-i koka sochi
English title	: Optional solidifying device for supercooling fluid

/1[1]

Specification

1. Title of Invention

Optional solidifying device for supercooling fluid

2. Scope of Patent Claims

(1) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is made up of a spring (1) with different graduating diameter that is made from shape memory alloy metal, a spring (2) made from stainless steel and a box (3) made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, the spring (1) made from the aforementioned shape memory alloy metal is compressed and displaced by the spring (2) made of stainless steel. When this spring made from the shape memory alloy metal is deformed, the spring (2) made of the aforementioned stainless steel is compressed and displaced.

(2) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is made up of (5) a spring made from shape memory alloy metal, a spring (6) made from stainless steel

---

1 Numbers in the margin indicate pagination in foreign text.

and a box (7) made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, a sliding friction force is provided.

(3) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with springs (11), (13) of the coil shape having a tight part. The sliding friction force is provided at the tight part during the displacement of these springs (11) and (13).

(4) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with springs (11), (50) of the coil shape having a tight part and the switches (22) and (46) that generate the sliding friction force at the tight part as the springs (11) and (50) are displaced.

/2

(5) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with container (28) where the supercooling fluid is displaced inside and a rod (32) that is

compressed into the aforementioned container (28) by the spring (31). A sliding frictional force is generated between the aforementioned container (28) during rotation of this rod (32).

(6) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with a container (28) where the fluid in the supercooling state is displaced inside and a rod (34) that is maintained by a spring (35) having a tight part that is provided between this container (28). The sliding friction force is generated at the tight part of the spring (35) during the rotation movement of the aforementioned rod (34).

3. Detailed explanation of the invention

The invention pertains to an optional solidifying device for supercooling fluid. In particular, it pertains to an optional solidifying device for supercooling fluid where the latent heat is used to solidify the supercooling fluid which is a heat accumulation material.

(The problems resolved by the invention)

In general, among the latent heat type heat accumulating material, in particular, for example, an inorganic hydrate, this does not solidified above the melting temperature, the supercooling is too large. As the latent heat is released at the melting temperature, supercooling is required for the optional solidification of this supercooling fluid that is in the room

temperature. The long term latent heat is possible due to a heat accumulation material.

Thus, the supercooling fluid can be solidified with the method of contact by self crystallization, the method of local cooling in the electronic cooling element, the method of radiating ultrasonic wave of specific wavelength but the device for implementing these methods are very expensive or the realization of the solidification is difficult and there are problems in these methods.

The purpose of the invention is to offer an optional solidifying device for the supercooling fluid that is inexpensive and the solidifying of the supercooling fluid can be realized effectively.

(Means for resolving the problems)

In order to achieve the above purpose, the invention pertains to an optional solidifying device for supercooling fluid that is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is made up of a spring with different graduating diameter that is made from shape memory alloy metal, another spring made from stainless steel and a box made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, the spring made from the aforementioned shape memory alloy metal is compressed and displaced by the spring made of stainless steel. This optional solidifying device for supercooling fluid is made up of a spring

made from shape memory alloy metal and another spring made from stainless steel and these are combined in a box made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, a sliding friction force is provided. This optional solidifying device for supercooling fluid is provided with two springs of the coil shape having a tight part. The sliding friction force is provided at the tight part during the displacement of these springs. It is provided with switches that generate the sliding friction force at the tight part as the springs are displaced. The optional solidifying device for supercooling fluid is provided with container where the fluid in the cooling state is displaced inside and a rod that is compressed into the aforementioned container. A sliding frictional force is generated in the aforementioned container containing the fluid in the cooling state during the rotation movement of this rod. The sliding frictional force is generated in the tight part of the spring during the rotation movement of the aforementioned rod.

/3

(Action)

By using the above described means, the invention can provide sliding friction force in the supercooling fluid. In addition, the sliding friction force can be provided with a rotation movement action, pressure action and at an elevated temperature on the supercooling fluid.

(Implementation examples)

The implementation examples of the invention are explained

below according to the diagrams shown below.

Figure 1 to figure 7 show the 1st implementation example of the optional solidifying device of the supercooling fluid according to the invention. The device is shown in this implementation example. First, the spring 1 made of shape memory alloy metal where the shape can be changed as the temperature of the adiabatic material of the fluid goes below the melting temperature as shown in figure 1 and a spring 2 that is made of stainless steel as shown in figure 2, these springs are combined inside a box 3 made of stainless steel as shown in figure 3. As shown in figure 4, this is formed with both ends fixed.

Then, this optional solidifying device of the supercooling fluid formed as described above is enclosed in the container sealed with the adiabatic material. First, the spring 1 made of shape memory alloy metal at room temperature is contracted and the spring 2 made of stainless steel is extended inside the aforementioned box 3 as shown in figure 4.

Therefore, the phase, the temperature and the heat amount of the adiabatic material be maintained in the state shown in figure 4.

Then, when the temperature of that heat accumulating material is heated above the fusion point, the spring 1 made from shape memory alloy metal is extended, the spring 2 made from stainless steel contracts and becomes in the state shown in figure 6.

In addition, after the heating reaches 100°C, when the temperature is reduced to below the fusion point again, the

optional solidifying device of the supercooling fluid is changed instantaneously to the state of figure 4 from the state of figure 6. Rebound is generated from this change. Therefore, latent heat is released at this time, it has temperature maintenance ability.

For example, the spring 1 made from the aforementioned shape memory alloy metal undergoes shape change at 55°C, the rebound is to the C' point of figure 7. As a result, the heat change is shown in the solid line.

Also, as shown in figures 8(a)(b) and figure 9(a)(b), these are the deformation example of the combination of the spring 5 made from the shape memory alloy metal and the spring 6 made from stainless steel.

The spring 6 made from stainless steel as shown in figures 8(a)(b) is extended in the box 7 made from stainless steel. When the spring 5 made from shape memory alloy metal is extended between the box 7 made from stainless steel and the center part of the spring 6 made from stainless steel, at the normal temperature, it is at the state shown in figure 8(a). When it is above the shape memory temperature of the shape memory alloy metal, it is transformed into the state shown in figure 8(b). Rebound is generated.

Also, as shown in figures 9(a)(b), the spring 6 made from stainless steel and the spring 5 made from shape memory alloy metal are extended in a straight row in the box 7 made of stainless steel. It is at the state shown in figure 9(a) during the normal temperature, when it is above the shape memory temperature of the

shape memory alloy metal, it changes into the state shown in figure 9(b). The rebound is generated due to this change.

Another implementation example according to another implementation of the device is shown in figures 10(a)(b) and figures 11(a)(b). As shown in this implementation example, the spring 11 made from stainless steel shown in figures 10(a)(b) and the spring 13 having the forks 12a and 12b shown in figures 11(a)(b).

As shown in figures 10(a)(b), it is placed at the state shown in figure 10(a) in the heat accumulating material which is the supercooling fluid, when an external force is provided, the fluid that is in contact to the tightly wound up part in the coiled form of spring 11 received the rapid pressure change, it is in the deformation shown in figure 10(b), the solidification begins. One end of the fork 12a is solidified as shown in figure 11(a)(b) and the fork 12b of the other end is compressed.

Therefore, the fluid that is in contact with the spring in the tightly coiled form received the rapid pressure by the sliding friction force of the tightly wound up part and solidification begins.

Thus, latent heat begin to be released due to this solidification.

/4

Figure 12 shows an example of the use of the device shown in figures 10(a)(b). The heat accumulating material 17 filled in the container main body 16 surrounding the adiabatic material 15 is in

the liquid phase is heated with a heater 18 provided at the lower part. Then, the heater 18 is switched off, the fusion liquid is cooled, this is maintained in the room temperature state as the super cooling fluid.

On the other hand, the round box container 20 having cylinder 19 is inserted into the center part at the upper part of the aforementioned container main body 16. The piston 22 positioned with the handle 21 on the upper part is provided to move vertically inside the aforementioned cylinder 19. A spring 11 is provided shown in figures 10(a)(b) in the position that faces the lower part of that piston 22.

Therefore, when the aforementioned piston 22 is lowered, one end of the piston 22 is in the state shown in figure 10(a), the aforementioned spring 11 is displaced and pressed into the state shown in figure 10(b). At this time, the heat accumulating material 17 is solidified by the sliding friction force of the tightly coiled part of the spring 11.

Also, the application example shows another implementation example that is shown in figure 13 and figure 14. The heat accumulating material 27 is filled inside the container main body 26 surrounding the adiabatic material 25. Also, the round box container 28 at the upper part is provided with a heater 29 at the lower part.

Then, the handle 30 in the aforementioned round box container 28 extends externally in the container main body 26. Rod 32 is provided to contact with the round box container 28 in the state

where the tip sliding part at the lower end is compressed by spring 31. Also, a part of the round box container 28 is connected to the inner part of the container main body part 26 via a hole 28a.

That is, in yet another implementation example, the optional solidifying device of the supercooling fluid is formed with the round box container 28 pierced with a hole 28a and the rod 32, the rod 32 is pressed into the round box container 28 containing the spring 31.

Therefore, with the above constitution, the rod exerts sliding friction between the bottom of the round box container 28 and the tip of the rod 32 as the aforementioned rod 32 is rotated. The latent heat is extracted as the heat accumulating material 27 solidifies in the supercooling state.

Also, for the device shown in figure 14, the heat accumulating material 27 is filled inside the container main body 26 surrounding the adiabatic material 25. Also, the round box container 28 at the top is provided with the respective heater 29 at the lower part.

Then, the handle 33 inside the aforementioned round container 28 extends to the outside of the container main body 26, the rod 34 is placed at the bottom end of the round box container 28. One end of the spring 35 is connected to the tip of this rod 34 and also the other end of the spring 35 is connected to the aforementioned round box container 28. Also, a part of the round box container 28 is connected to the inside of the container main body 26 via the hole 28a.

That is, the optional solidifying device of the supercooling

fluid is formed with the round box container 28 pierced with a hole 28a and the rod 34, the rod 34 is pressed into the round box container 28 containing the spring 35.

Therefore, with the above constitution, the rod exerts sliding friction between the bottom of the round box container and the tip of the rod as the aforementioned rod 34 is rotated by the aforementioned handle 33. The latent heat is extracted as the heat accumulating material 27 solidifies in the supercooling state.

In addition, another application of the device of another implementation example is shown in figure 15(a)(b), this is made up of a spring 40 and a switch 46 and this switch compresses into this spring 40. It shows the state where the temperature maintenance container 42 placed with a bowl 41 is mounted inside. This temperature maintenance container 42 is provided with a heat accumulating material 44 that is covered with an alumilaminate pack 43 inside. A spring 40 in the coil form is arranged having the tightly wound part via the alumilaminate heat seal 45 in the upper part of this alumilaminate pack 43. A switch 46 is provided at the position facing this spring 40.

Then, when the aforementioned switch 46 is pressed at the state when the heat accumulating material 44 is super cooled, the spring 40 is deformed as shown in figure 15 (b). At this time, it is solidified by the sliding friction force following the spring to be tightly coiled.

/5

Also, another example is shown from figures 16 to figure 18.

This shows the state that the spring is being mounted on the top part of the temperature maintenance container. This spring 50 in the coil form is placed facing the aforementioned switch 46 as shown in figure 17. During the sliding friction, the spring is displaced and it is in the coiled form as the aforementioned switch 46 is pressed, the heat accumulating material in the super cooling state change to a different phase, the latent heat is extracted.

Figure 18 shows another application example shown for the case where the device shown in figure 17 is used. A alumilaminate pack 53 filled with the heat accumulating material 52 is provided inside the side and bottom parts of the container main body 51. The same alumilaminate pack 53 is arranged in the container cover 55. A alumilaminate heat seal 54 is arranged on the upper part of the alumilaminate pack 53 provided in the container main body 51, a spring 50 is provided in this container. Switch 46 protrudes to the outside of the container main body 51. With such a constitution, when this switch 46 is pressed, the aforementioned spring is displaced. At this time, the super cooling fluid solidifies as the latent heat is extracted.

(Effect of invention)

According to the invention as described above, when the temperature of the fluid that is in the supercooling state is in a certain temperature, the fluid solidified at any time when the compression work is performed, at this time, the latent heat that is contained in the fluid can be extracted. In addition, since the whole device is fairly compact, it can be mounted easily in other

equipment. Also, since it has an extremely simple structure, it can be manufactured inexpensively which is an advantage.

4. Brief description of the diagrams

Figures 1 - figures 7 show the implementation example of the device according to the invention. Figure 1 is the diagram showing the spring made from the shape memory alloy metal. Figure 2 is the diagram showing the spring made from stainless steel. Figure 3 is the diagram showing the box made from stainless steel. Figure 4 is the diagram showing the state of combining the device of figures 1 to figure 3. Figure 5 is the diagram showing the relationship between the heat accumulation amount and the phase of the temperature of the heat accumulating material. Figure 6 is the diagram showing the state where the device is transformed as shown in figure 4. Figure 7 is the diagram showing the state of the heat transformed in the relationship between the heat accumulation amount and the phase of the heat accumulating material. Figure 8 (a)(b) and figure 9 (a)(b) are the diagrams showing the transformation example of the implementation examples. Figure 10 (a)(b) and figure 11(a)(b) show another example of the device according to the invention. Figure 12 is the diagram showing an example using the device shown in figures 10 (a)(b). Figure 13 and figure 14 are the diagrams showing an example of the application of the device shown in figures 10(a)(b) and figures 11 (a)(b). Figure 15 (a)(b) are the diagrams showing another example of the device according to the invention. Figure 16 is the diagram showing another variation of the example of the device shown in figure 15

(a)(b). Figure 17 is the diagram showing the spring shown in figure 16. Figure 18 is the diagram showing another variation of the example of the device shown in figures 15 (a) (b).

1,5 - spring made from shape memory alloy metal

2,6 - spring made from stainless steel

3,7 - box made from stainless steel

11, 13, 31, 35, 40, 50 - spring

12a, 12b - fork part

15, 25 - adiabatic material

16, 26 - container main body

17, 27, 44, 52 - heat accumulating material

18, 29 - heater

19 - cylinder

30,33 - handle

22 - piston

28 - round box container

32, 34 - rod

41 - bowl

42 - temperature maintenance container

43, 53 - alumilaminate pack

45, 54 - alumilaminate heat seal

46 - switch

51 - container main body

第 1 図

Figure 1

1 - spring made from shape memory alloy metal

第 2 図

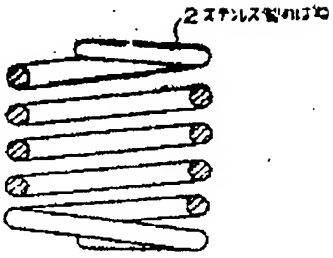


Figure 2

2 - spring made from stainless steel

第 3 図

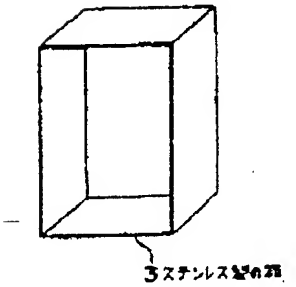
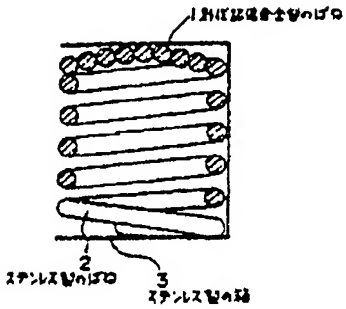


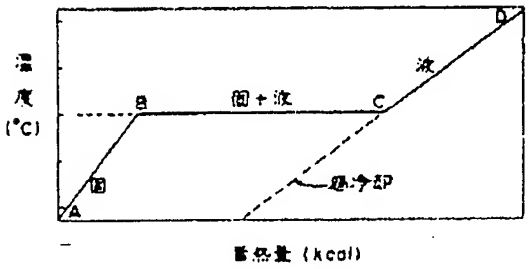
Figure 3

3 - box made from stainless steel

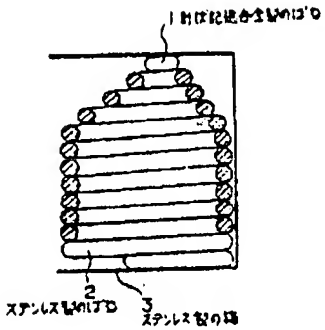
第 4 図



第 5 図



第 6 図



第 7 図

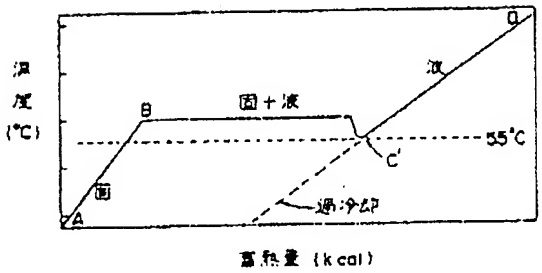


Figure 4

1 - spring made from shape memory alloy metal

2 - spring made from stainless steel

3 - box made from stainless steel

Figure 6

1 - spring made from shape memory alloy metal

2 - spring made from stainless steel

3 - box made from stainless steel

Figure 5

Temperature (°C)

A-B: solid

B-C: solid + liquid

-C: supercooling

C-D: liquid

heat accumulating amount (kcal)

Figure 7

Temperature (°C)

A-B: solid

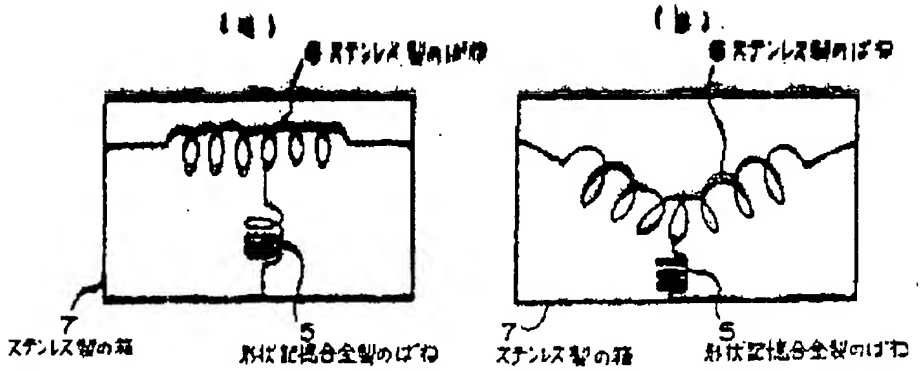
B-C: solid + liquid

-C: supercooling

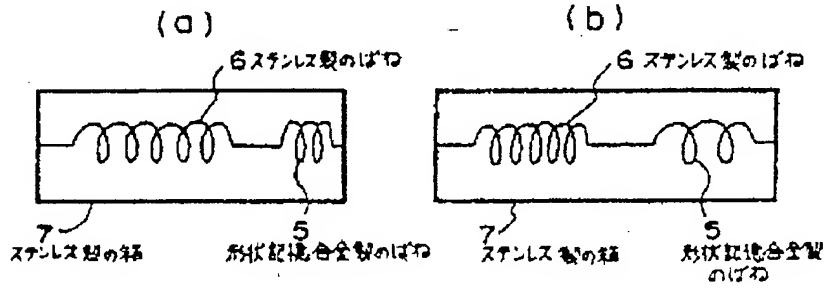
C-D: liquid

heat accumulating amount (kcal)

第 8 図



第 9 図



Figures 8 and 9.

(a)

6 - spring made from stainless steel

7 - box made from stainless steel

5 - spring made from shape memory alloy metal

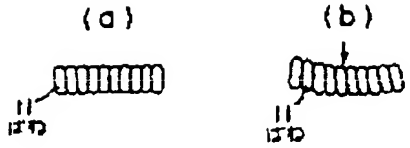
(b)

6 - spring made from stainless steel

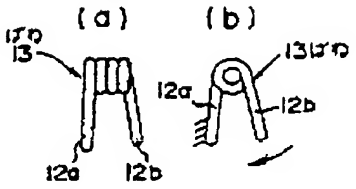
7 - box made from stainless steel

5 - spring made from shape memory alloy metal

第 10 図



第 11 図



第 12 図

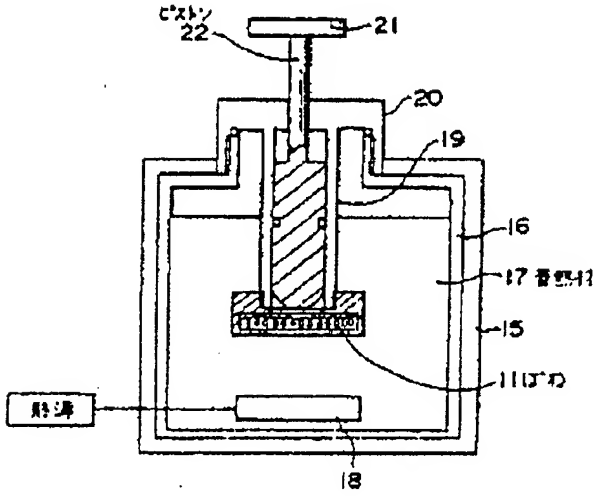


Figure 10

(a) 11 - spring

(b) 11 - spring

Figure 11

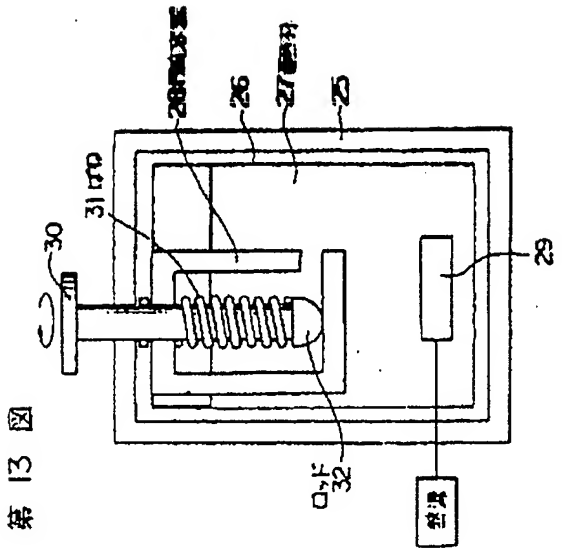
(a) 13 - spring

(b) 13 - spring

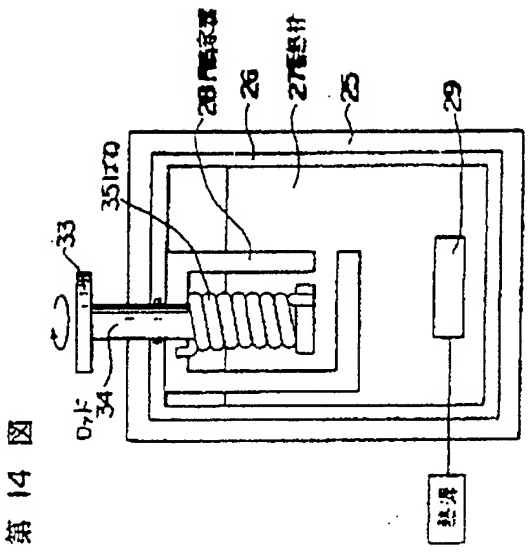
Figure 12

22 - piston

17 - heat accumulating material



第 13 図



第 14 図

Figure 13

31 - spring

28 - round box container

27 - heat accumulating material

32 - rod

29 - heat source

Figure 14

34 - rod

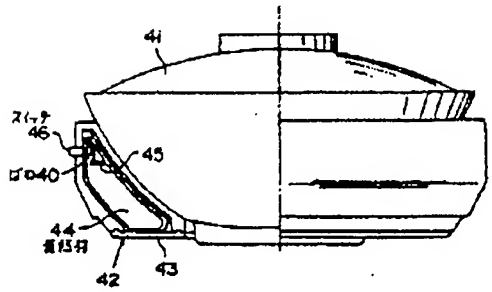
35 - spring

28 - round box container

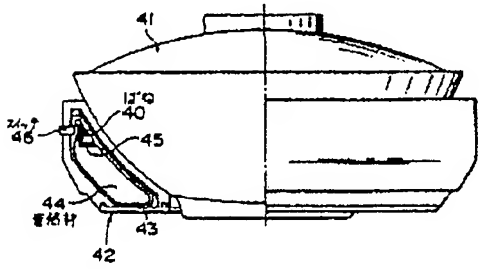
27 - heat accumulating material

29 - heat source

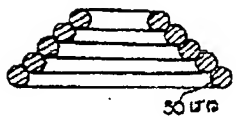
第 15 図
(a)



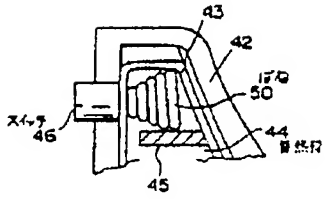
第 15 図
(b)



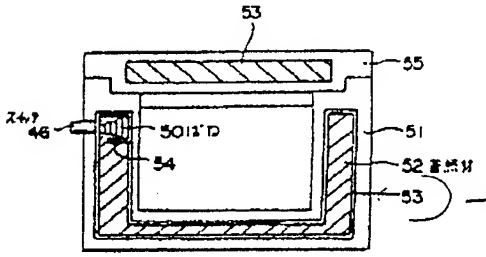
第 17 図



第 16 図



第 18 図



54 – aluminate heat seal

Figure 15(a)

46 - switch

40 - spring

44 - heat accumulating material

Figure 15(b)

46 - switch

40 - spring

44 - heat accumulating material

Figure 17

50 - spring

Figure 16

46 - switch

50 - spring

44 - heat accumulating material

Figure 18

46 - switch

50 - spring

52 - heat accumulating material

Amendment

November 30, 1988

Patent Commissioner

1. Display of Article

63 - 102089

2. Title of invention

Optical solidifying device of supercooling fluid

3. Person making the Amendment

Relationship to Article: Patent Applicant

Address and Name

4. Agent

Address and Name

5. Date of Amendment Instruction

6. Object of Amendment

The sections in the Specifications, "Detailed explanation of the invention", "Brief explanation of the diagrams" and the diagrams

7. Contents of the Amendment

(1) The "Scope of the Patent Claims" of the Specification is amended according to the attached.

(2) "the Cooling state" of lines 12 and line 15 of page 6 of the same Specification are corrected to "the super cooling state".

(3) "during the rotation movement" of line 16 and line 18 of the

same page and same Specification are corrected to "during the rotation".

(4) "the rotation movement action" of line 15 of page 7 of the same Specification is corrected to "the rotation action".

(5) "surenresu" of line 3 of page 8 of the same specification is corrected to "stainless".

(6) "during normal temperature" of line 17 and line 10 of page 9 of the same specification is corrected to "during heating".

(7) "above shape memory temperature" of line 18 and line 11 of the same page and same specification is corrected to "under shape memory temperature".

(8) "following" of line 2 of page 15 of the same specification is corrected to "as".

(9) "53... container cover 55" of lines 18 - 19 of the same page and same specification is corrected to "adiabatic material 58 in the container cover 55:.

(10) "figure 13 is and" of line 12 of page 17 of the same specification is corrected to "figure 13 and"

(11) Diagram (figure 18) is corrected according to the attached.

8. Contents of the attached documents

(1) attached document - 1 copy

(2) diagram (figure 18) - 1 copy

Attached document

Scope of Patent Claims

(1) The optional solidifying device for supercooling fluid is

characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is made up of (1) a spring with different graduating diameter that is made from shape memory alloy metal, a spring (2) made from stainless steel and a box (3) made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, the spring made from the aforementioned shape memory alloy metal (1) is compressed and displaced by the spring (2) made of stainless steel. When this is deformed, the spring (2) made of the aforementioned stainless steel is compressed and displaced.

(2) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state, this optional solidifying device for supercooling fluid is made up of (5) a spring made from shape memory alloy metal, a spring (6) made from stainless steel and a box (7) made from stainless steel that contained the two springs in the loaded state. When the shape memory alloy metal is deformed, a sliding friction force is provided.

(3) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with springs (11), (13)

of the coil shape having a tight part. The sliding friction force is provided at the tight part during the displacement of these springs (11) and (13).

(4) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with springs (11), (50) of the coil shape having a tight part and the switches (22) and (46) that generate the sliding friction force at the tight part as the springs (11) and (50) are displaced.

/10

(5) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with container (28) where the fluid in the supercooling state is displaced inside and a rod (32) that is compressed into the aforementioned container (28) by the spring (31). A sliding frictional force is generated between the aforementioned container (28) during rotation of this rod (32).

(6) The optional solidifying device for supercooling fluid is characterized as a device for extracting the latent heat by providing the sliding friction force in the heat accumulating material in the supercooling state. This optional solidifying device for supercooling fluid is provided with a container (28)

where the fluid in the supercooling state is displaced inside and a rod (34) that is maintained by a spring (35) having a tight part that is provided between this container (28). The sliding friction force is generated at the tight part of the spring (35) during the rotation of the aforementioned rod (34).

第 18 図

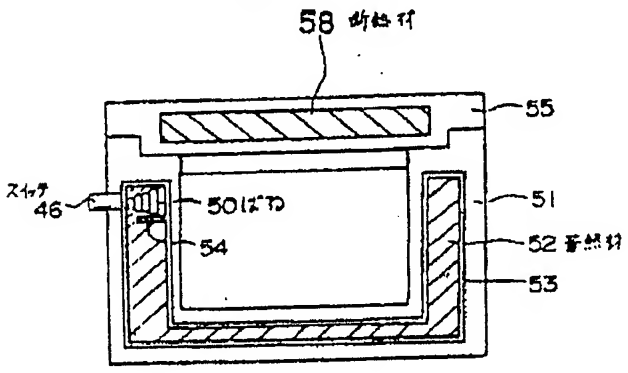


Figure 18

58 - adiabatic material

46 - switch

50 - spring

52 - heat accumulation material